Apr. 3, 1923. 1,450,290

H. W. HARDINGE

OVERSIZE RETURN FOR MILLS

Filed June 4, 1920

Fig. 2.

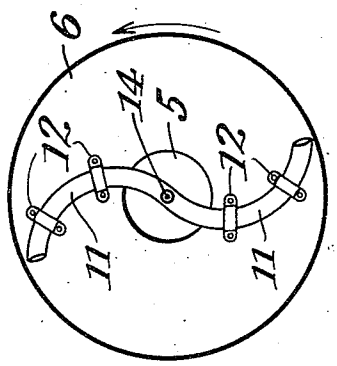
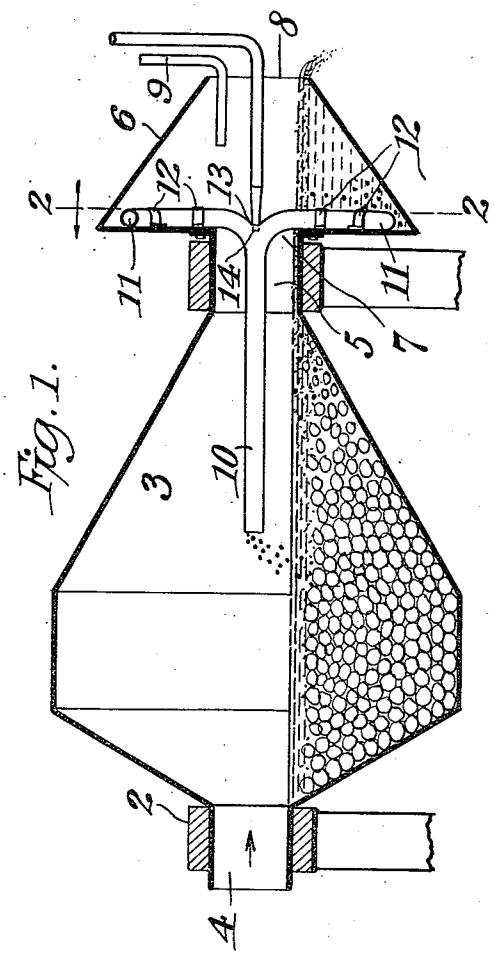


Fig. 1.



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UNITED STATES PATENT OFFICE.

HARRY W. HARDINGE, OF NEW YORK, N. Y.

OVERSIZE RETURN FOR MILLS.

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To all whom it may concern:

Be it known that I, HARRY W. HARDINGE, a citizen of the United States of America, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Oversize Returns for Mills, of which the following is a full, clear, and exact description.

The invention which constitutes the subject matter of this application relates to grinding mills and has for one of its principal objects to provide a novel form of means for automatically returning oversize material which is discharged from such mills to the rotating drum thereof for regrinding.

In the operation of cylindrical grinding mills a certain amount of oversize material is discharged along with the fines. In conical mills the percentage of oversize discharged is comparatively small due to the inherent classifying action of this type of mill. Nevertheless in the latter type of mills, crowded or operated beyond normal capacity, there is a certain amount of oversize in the discharge. In accordance with the present invention I provide a classifier of cylindrical, conical or other suitable form, into which the drum discharges, and provide means for automatically returning oversize material from the classifier to the grinding drum through the outlet opening of the latter, for regrinding. Numerous advantages which are incident to this arrangement will be apparent as some of the physical embodiments are hereinafter described.

Referring to the drawings which illustrate what I now consider preferred forms of my invention:

Fig. 1 is a somewhat diagrammatic sectional elevation of a conical mill embodying my invention.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Directing attention to Fig. 1 it will be seen that the mill there shown comprises a drum 1 journaled for rotation in bearings 2, 2. The said drum is adapted to receive material to be ground through the inlet trunnion 4, to grind or disintegrate the same, to classify it according to size by means of the conical outlet 3, and to discharge the fines through the outlet trunnion 5. It will be understood, of course, that the drum 1 may be rotated by any suitable means and provided with balls, pebbles, rods or other suitable grinding media well known in the art.

As stated above a certain amount of oversize is discharged with the fines through the outlet opening 5. I therefore provide a classifier to receive the discharge of the drum 1 and automatically to separate the oversize from the fines. One form of classifier is shown in Figs. 1 and 2 and comprises a substantially cone-shaped barrel 6 secured at its base to the outlet trunnion of the drum 1 to rotate therewith. It will be noted that the barrel 6 is provided with an opening 7, which registers with the outlet opening 5, and an outlet opening 8. Water or other liquid is supplied to the barrel 6 in any one or more of various ways. If the drum 1 is to perform wet grinding, water may be supplied with the primary material through the inlet opening 4, or in a manner hereinafter more specifically described. The water so introduced will then flow through the drum 1 and out through the opening 5 into the barrel 6. The outlet opening 5 is preferably so arranged that its bottom or lower part is lower than the bottom of the inlet opening 4. The water entering the barrel 6 at 7 flows therethrough and leaves at opening 8, the lower edge of which is preferably lower than the lower edge of openings 5 and 7. The fines leaving the drum 1 and entering the barrel 6 flow through the latter with the stream of water and are discharged at 8, but the oversize material, being heavier, sinks to the bottom of the barrel 6. If desirable water or liquid may be supplied to the barrel 6 through a stationary pipe or conduit 9.

Means are also provided for automatically returning the oversize from the barrel 6 to the drum 1 for regrinding. One form of such means is illustrated in Figs. 1 and 2 and may be constructed substantially as follows. A conveyer or conduit 10 extends, from the barrel 6, substantially axially into the drum 1 through the opening 5 of the latter. The conveyer 10 terminates, inside the barrel 6, in one or more branches 11, each communicating at one end with the pipe 10 and each adapted at its other end to scoop up oversize from the bottom of the barrel 6 when the branches 11 are rotated in the direction of the arrow shown in Fig. 2. In order to cause rotation of the conveyer 10—11 the branches 11, 11 may be secured to the base of the

cone-shaped barrel 6 by means of cleats or straps 12 clearly shown in Fig. 2. Obviously on rotation of the barrel 6 in the direction of the arrow (Fig. 2) the oversize will be scooped up from the bottom of the barrel 6 and impelled through the tube 10 into the drum 1, there to be subjected to regrinding. If it is desired to increase the flow of the oversize through the conveyer 11—10, the latter may be provided with an axial opening 13 through which a suitably supported stationary nozzle 14 extends, said nozzle being supplied with liquid or gas under pressure.

The operation of the mill shown in Figs. 1 and 2 will be clear to those skilled in the art, in view of the foregoing description.

Among other advantages, I wish to call attention to the fact that my invention may readily be applied to mills which are already built or in use. The oversize-return conveyer lies within the lateral confines of the grinding drum thus minimizing space and protecting the said conveyer. Also, in view of the function performed, the length of the conveyer tubes or pipes is minimized.

In accordance with the provisions of the patent statutes, I have herein described the principal of operation of my invention, together with the apparatus which I now consider to represent the best embodiments thereof but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results and effects outlined, and the invention extends to such use.

What I claim is:

1. A grinding mill comprising in combination, a rotatable grinding drum having a substantially unobstructed overflow conical outlet portion for the classification of material according to size, a classifier into which said drum discharges, and means for automatically returning oversize material from said classifier to said drum through the end of said conical outlet portion.

2. In combination, a rotatable grinding drum having a substantially unobstructed overflow conical outlet portion for the classification of material according to size, a substantially cone-shaped rotatable classifying member into which said drum discharges, and means for returning oversize material from said classifier to said drum through the end of said conical outlet portion while said drum and member are rotating.

3. In combination, a rotatable grinding drum having a substantially unobstructed overflow conical outlet portion for the classification of material according to size, a substantially cone-shaped classifier secured to said drum to rotate therewith and to receive the discharge therefrom, and a conveyer tube rotatable with said drum, extending at one end into the conical outlet thereof and terminating at its opposite end in at least one arm communicating with said classifier adjacent the large portion of the latter.

4. A grinding mill comprising in combination, a rotatable grinding drum having a substantially unobstructed overflow conical outlet portion for the classification of material according to size, a second drum into which said first named drum discharges, and means comprising a spiral conveyer for returning oversize material from said second drum to said first drum through the end of the conical outlet of the latter, said second drum having a sloping wall for deflecting material toward an inlet end of said spiral conveyer.

5. A grinding mill comprising in combination, a rotatable grinding drum having a substantially unobstructed overflow conical outlet portion for the classification of material according to size, a classifier into which said drum discharges, and means for automatically returning oversize material from said classifier through said conical outlet portion to the interior of said drum at a point nearer to the base of the conical outlet than to the apex thereof.

6. In combination, a rotatable grinding drum having a substantially unobstructed overflow conical outlet portion for the classification of material according to size, a classifier into which said drum discharges, means for causing liquid to flow through said classifier to carry out the fines, and means for automatically returning oversize material from said classifier to said drum through said conical outlet portion.

7. In combination, a rotatable grinding drum having a substantially unobstructed overflow conical outlet portion for the classification of material according to size, a substantially cone-shaped classifier secured at its larger end to said drum to rotate with said drum and to receive the discharge therefrom, and a conveyer tube rotatable with said drum, extending at one end into the conical outlet thereof and having another end in communication with said classifier adjacent the larger end of the latter.

8. In combination, a rotatable grinding drum having a trunnion outlet portion, a classifier secured to said drum to rotate therewith and to receive the discharge therefrom, a conveyer tube rotatable with said drum, having an end extending into said trunnion outlet and another end in

communication with said classifier, and means for supplying fluid under pressure to said tube to impel material therethrough.

9. A grinding mill comprising in combination, a tumbling barrel comprising an inlet portion having an opening for the introduction of material to be disintegrated, a conical outlet and means connecting the same at its base to the inlet portion, the slant of the lower side of the said conical outlet portion relative to the perpendicular or direction of gravity being not less than 45° nor more than 70°, approximately, means for supporting the barrel for rotation about its longitudinal axis, a classifier into which said drum discharges, and means for automatically returning oversize material from said classifier to said barrel through the end of said conical outlet while said barrel is rotating.

In testimony whereof I hereto affix my signature.

HARRY W. HARDINGE.